

THE IMPACT OF INTENSIFIED AIR ATTACKS
AGAINST ECONOMIC TARGETS IN NORTH VIETNAM

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Summary

This memorandum analyzes the economic and social effects of a postulated escalation of the US/GVN air offensive against North Vietnam which, if successfully executed, would deny essential supplies to almost all modern industrial activity in North Vietnam. Under this assumption, the country would also lose two-thirds of its power-generating capacity and more than 95 percent of its bulk petroleum storage capacity. Both rail transport and seaborne foreign trade would be greatly reduced. As a consequence, industrial production would be practically ground to a halt.

In spite of these severe economic hardships, the regime would be able to feed and to control its population, to maintain essential imports, and to maintain the small flow of supplies needed to continue its support of Communist forces in Laos and South Vietnam, both at present or at significantly increased scales of combat. It is unlikely that the level of escalation considered in this memorandum would be sufficient in terms of economic losses alone to bring the regime into negotiations to end the war in Vietnam.

North Vietnam is an essentially agrarian society with more than 85 percent of the population living in rural areas. Consumer demand is extremely low and is focused almost exclusively on minimum requirements for food, shelter, and clothing. These wants could be largely satisfied by the regime even if the thin veneer represented by North Vietnam's modern economy were eliminated completely.

The intensified air attacks analyzed in this memorandum would probably cause an overall but indeterminate decline in civilian morale, but the damage inflicted by these attacks is not likely to cause the populace to be unwilling to support the regime and its conduct of the war. Indeed, there is reason to believe that at least initially the attacks would fortify and unify the people in their resistance to the United States. How long this determination would continue to be high under prolonged bombing and mounting casualties in the South cannot be estimated. The regime should be able to cope with the postattack distribution problems involved in feeding the population. Among the measures it would adopt are the use of primitive means of transport to distribute food and the further relocation of urban populations, particularly those unemployed in the industrial sector.

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The estimated civilian casualties resulting from the attacks on fixed targets would be at least 2,000 to 3,000. If armed reconnaissance is carried on at the level authorized for each Rolling Thunder program in late 1965, there would be at least an additional 300 civilian casualties for each 1,200 armed reconnaissance sorties.

The experience in 1965 indicates that air interdiction of lines of communication has not halted the flow of men and supplies into North Vietnam or into Laos and South Vietnam. The North Vietnamese have shown a remarkable ability both to maintain and to increase the volume of supplies moved into Laos and South Vietnam. They have, moreover, increased the capacity of the major supply routes. Even after an intensified air offensive of the same type as in 1965, North Vietnam could continue to provide the Communist forces in South Vietnam with an average of 12 short tons* of supplies per day. They would appear also to have the capability to provide the 165 short tons of supplies per day estimated to be required by an expanded PAVN/VC main force of 155 battalions fighting at intensified scales of combat at the end of 1966. Although an escalation of the bombing undoubtedly would increase the difficulty of logistical support and would force North Vietnam to undertake emergency measures to maintain the flow of supplies, there would seem to be no way, short of physical occupation, to attain a complete halt in the flow of supplies to South Vietnam by using conventional weapons.

The logistic funnel through Laos is needed to provide only a small volume of supplies since the Communist forces in South Vietnam are almost completely independent of the economy of North Vietnam. Therefore, economic loss alone will neither affect the ability of the regime to support the war nor necessarily induce it to negotiate to end the war. Although the heavy losses to modern industrial facilities might possibly induce the Hanoi regime to abandon its objectives in South Vietnam, under present conditions this response to the bombing seems unlikely. The more important factors shaping the attitude of the regime would appear to be the certain anticipation or actual experience of unacceptably high losses and defeats to the VC and PAVN in the South or the discontinuance of aid from other Communist countries, particularly the USSR. Continuing destruction in the North would very likely reduce the leadership's willingness to maintain the war effort, if and when the tide turns against them in the South.

* Unless specifically identified as short tons, tonnages are given in metric tons.

1. Assumptions

This memorandum presents an analysis of a postulated escalation of the US/GVN air offensive against North Vietnam. The analysis assumes a completely successful intensification of aerial attacks against targets of economic and military significance within the general Hanoi-Haiphong area.* The attack specifically analyzed represents an expansion of the air offensive to a level deemed appropriate to attain an effective halt of most of the modern economic activity in North Vietnam.** The major target groupings included in this analysis are: (a) four of the principal electric power facilities; (b) the nine remaining major petroleum storage facilities; (c) thirty-four bridge and transport targets, including the rail connections to China and the port facilities at Haiphong; and (d) aerial mining of the major ports. The analysis also includes an evaluation of the impact of these strikes on (a) economic activity within North Vietnam; (b) the secondary economic and social effects within the country; and (c) the probable level of civilian casualties resulting from these attacks and from strikes against other significant military targets.

2. Background

The North Vietnamese economy, which is basically one of subsistence agriculture, has only a small modern industrial sector concentrated in a few urban centers, including Hanoi, Haiphong, Nam Dinh, Viet Tri, and Thai Nguyen. The country imports little food even in poor agricultural years and depends largely on domestic production to feed its population of about 18 million persons. More than 80 percent of the population is engaged in agriculture, which in 1964 accounted for almost one-half of the gross national product (GNP). North Vietnam produces only minor items of military equipment -- grenades, mines, mortars, and ammunition for small arms -- and must import all of its heavy military equipment and most of its small arms, ammunition, and medical supplies from Communist countries.

The industrialization program of North Vietnam has concentrated on the development of a machine building industry, a chemical industry, a food processing industry, and several other light industries which constitute the core of the new modern industrial structure of the country. The country also is building with Chinese aid a 100,000-ton steel mill

** For the location of these targets, see the accompanying map; for an annotated listing, see the table in Appendix C.

** For a discussion of alternative target systems, see Appendix D.

at Thai Nguyen which is already producing pig iron and which was expected to be producing crude steel and some rolled products by the end of 1965.

This small industrial sector is heavily dependent on imports of machinery and raw materials, principally from Communist China and the USSR. The foreign trade of North Vietnam, which has been such an important factor in the economic development of the country, was equal to about 15 percent of GNP in 1964.

Through the end of 1965, this small industrial sector has been relatively untouched by the US/GVN air offensive. In spite of the interdiction of rail transport connections to Communist China, rail imports in 1965 exceeded the level of 1964. Seaborne imports and exports in 1965 also exceeded 1964 levels. The infiltration of men and supplies into South Vietnam also increased.

3. Direct Effects on Economic Activity

The successful execution of the air offensive postulated in this memorandum would bring activity in the modern industrial sector to a quick halt. The losses resulting from these attacks would be serious and would create severe hardships. They would not, however, preclude continued support for the Communist forces in South Vietnam, nor would these economic losses alone compel the leadership of North Vietnam to enter into negotiations to end the war in Vietnam. A decision to negotiate would probably be dependent on some indeterminate combination of economic and human losses in North Vietnam, unacceptable military defeats in South Vietnam, and external pressures of the denial of assistance from other Communist powers.

The speed and extent of the breakdown of North Vietnam's modern industrial sector would depend on the way in which the attack was carried out. The fullest and most immediate impact on the economy would be achieved by the simultaneous and swift execution of all of the assumed attacks on electric power installations, petroleum storage facilities, internal lines of communications, major port facilities, and the aerial mining of major ports. On the other hand a slower schedule could possibly have a greater harmful impact on public morale through the combined effects of exposure to air attacks over a longer period of time and the frustrations of trying to cope with reconstruction and repair problems under conditions of repeated strikes and restrikes on targeted areas.

The escalated air offensive analyzed in this memorandum would stop almost all modern industrial activity for a number of reasons. The attack on electric power installations would raise total losses in generating capacity to 118,000 kilowatts, or 67 percent of total generating capacity* that existed before the onset of the Rolling Thunder program. Almost all of modern industry -- the exceptions being some industry at Haiphong and Viet Tri -- would cease operations. Activity at the port of Cam Pha would also be severely disrupted. From 30 to 40 percent of the electric power supplied to agriculture would be cut off. The effect here would not be felt until the spring harvest. The degree to which agriculture would be affected cannot be estimated without specific knowledge of the areas affected and the measures which might be adopted to offset the loss of power supply. The attack on electric power facilities would be sufficient to prevent a complete restoration of North Vietnam's main power grid for a period of at least one to two years.

The attack on petroleum storage facilities would eliminate more than 95 percent of national storage capacity, but the effect of this loss on economic and military activity would be only temporary.** The immediate economic effects would be felt only slightly in industry, which does not use petroleum as an energy source. The major impact would be on transport. The distribution of food, raw materials, and finished products would be rather thoroughly disrupted. Stockpiles of petroleum available after the attack would amount to less than a month's normal requirements. Within a short time, however, the regime could probably cope successfully with the loss of petroleum storage. Essential civilian transport in the postattack situation could be handled by other than motorized vehicles. Military transport could be satisfied by emergency measures to bring in essential petroleum requirements.***

The initial destruction and continued interdiction of transport targets would cause rail transportation to cease almost completely.*** Seaborne foreign trade would be greatly reduced by the mining of the major ports and attacks on port facilities. Many of the transport problems in the civilian sector would be ameliorated by the reduced requirements for transport that would result from the cessation of most industrial production and the inability to maintain most export trade. The immediate problems associated with distribution of food are lessened by the fact that the harvest is already in and distributed. Moreover, the highly decentralized system of food storage lessens the requirement for transportation.

* See Appendix A.

** See Appendix B.

*** See Appendix C.

4. Economic and Social Effects

a. Economic Effects

Modern industry, accounting for about one-half of gross industrial output, and industrial construction would come to an almost complete halt under the assumed attack. There would be a sharp setback to North Vietnam's economic development program. The repercussions of the breakdown of modern industry, would, however, be limited by the primarily self-sufficient nature of the subsistence sector, which supports about 85 percent of North Vietnam's 18 million people. The impact of even a complete loss of its modern industrial base would be a matter of direct concern to only a small element of the North Vietnam society. Most of the population leads a fairly primitive life with simple wants and needs. North Vietnam's small modern economy is not consumer-oriented. Only a small segment of the society would find its daily routine or standard of living measurably impaired if the industrial base ceased to operate. More than one-half million non-agricultural workers would be released from their jobs, but most of these workers would undoubtedly be reemployed in reconstruction and transportation. The morale and productivity of the nonagricultural labor force probably would decline because of the transfer from normal work, the regime's probable demand for further amounts of uncompensated labor, and the separation from families as a result of new job assignments or the probable further evacuation of dependents from urban areas. But these effects would be felt directly by such a small segment of the population that they would neither control the reactions of the rest of the country nor be compelling enough to shape the attitude of the policy-makers.

The further decrease in the normally tight supplies of food and other essential consumer goods as a result of the disruption of the transportation system and denial of imports might also have a harmful impact. North Vietnam is basically self-sufficient in food, however, and the distribution problems resulting from the disruption of transport could lead at the most to only minimal food shortages in some smaller urban areas and in the already food-deficit regions in the southern, northwestern, and northeastern parts of the country. Evacuation of urban residents, which is currently underway, would undoubtedly be stepped up to relieve food shortages. The recent replenishing of food stocks from the fall harvest plus the proximity of North Vietnam's major urban areas -- Hanoi, Haiphong, and Nam Dinh -- to surplus rice-growing regions would permit adequate supplies of food to these areas. The likely influx of evacuees from urban centers and other food-deficit

areas into normally self-sufficient rural areas would reduce per capita availabilities of food there, and possibly would provoke the hostility of local residents toward the newcomers.

Severe problems probably would not arise in the supply of essential civilian goods. Other than food the major requirement is for clothing, but shortages of clothing would be felt only in the long run and would be ameliorated by North Vietnam's moderate climate. With the exception of combat-related pharmaceuticals, medicines are in short supply and could become a critical item, but resupply could be a relatively simple logistic problem.

b. Social Effects

The execution of the intensified program of air attacks could probably cause an overall decline in civilian morale. The experience of the World War II air offensives in both Germany and Japan would indicate that aerial bombing, even in these economically advanced countries, does not produce a politically significant decline in public morale until the damage inflicted is so pervasive and irreparable that the will and ability of the populace to support the war are thoroughly shattered. In view of the limited impact of the intensified air attack analyzed in this memorandum, it is unlikely that civilian morale in North Vietnam would decline to the point that it would become a significant factor in influencing the regime's policy decisions on continuing to support the war in South Vietnam. There is no evidence that the ten months of continuous bombings in the southern part of the country have as yet created serious morale problems in that part of North Vietnam. According to letters written by residents in this area, the almost daily bombings have generated fear and apprehension but have at the same time produced a strong patriotic and angry response to the attacks, thus contributing to the regime's ability to mobilize the population.

The people, apparently with a minimum of coercion, have evacuated populated areas, restricted private travel, and accepted considerable adjustment in their normal economic and social activity. The influx of people into rural areas has actually helped to relieve the manpower shortage created by the draft of personnel for military service and reconstruction. The population of the Hanoi-Haiphong area would probably react similarly when subjected to aerial attack. Personal letters from the population of these areas continue to reflect a large degree of public support for the regime's war effort.

Both the public and private statements of the North Vietnamese leaders indicate that Hanoi fully expects an escalation of the air attacks to include all worthwhile military and economic targets within the Hanoi-Haiphong heartland. Their statements and actions suggest that they are prepared to accept this destruction as part of the cost of successfully achieving Communist objectives in South Vietnam and that they will endure the bombings at least until the fighting in South Vietnam turns decisively against them.

5. Effect on the Waging of the War

The type of war currently being waged by the Communist forces in South Vietnam remains essentially guerrilla warfare. It is characterized by hit-and-run tactics and a general unwillingness of Communist forces to engage in frontal combat with the opposing forces.

The Communist forces in South Vietnam have only a minimal dependence on the economy of North Vietnam. The guerrilla forces are almost completely self-sufficient. The main force is dependent for supplies from external sources for only the smaller part of its needs -- principally quartermaster goods such as medical supplies and signal equipment and weapons and ammunition. These supplies are not produced in North Vietnam and are supplied almost wholly by other Communist countries.* Thus a collapse of the modern industrial sector would have almost no impact on the military activity in South Vietnam.

The effort required to satisfy the logistic requirements of the Communist main forces in South Vietnam is small. At the level of combat prevailing during most of 1965 the requirement for logistic support from abroad is estimated at about 12 short tons per day. Even at the current projection of the probable maximum buildup of PAVN and Viet Cong main forces during 1966, the external logistic requirement would be only 165 short tons a day.**

The North Vietnamese have developed an effective and relatively invulnerable system to infiltrate men and supplies into South Vietnam. The capacity of the recently improved primary infiltration route through the Laotian panhandle has been reduced by US/GVN interdiction measures

* A fairly important exception is the procurement through normal trade channels of medical supplies from some non-Communist countries.

** This requirement is calculated for a main force of 155 PAVN/VC battalions engaged in combat once in every three days.

to an estimated 400 short tons per day. This capacity is more than adequate to meet the current logistic requirement of the Communist main forces in South Vietnam. The capacity of this route would also meet the logistic requirements of an expanded main force engaging in a scale of combat considerably more intensive than that waged to date.*

If both the buildup of the PAVN/VC main forces and the scale of combat should approach the point of exhausting the capacity of the supply funnel through Laos, the North Vietnamese could then resort to sea infiltration or the use of Cambodia to augment the flow of supplies.

During 1965 the US/GVN air offensive included a determined effort to cut off the flow of supplies moving through Laos. In spite of this interdiction, the North Vietnamese have demonstrated a remarkable ability not only to maintain and to increase the movement of men and supplies but also to increase the basic capacity of this supply network. Although the attack analyzed in this memorandum would make logistic support more difficult and require more emergency measures, the tonnages involved are so small that there would seem, in effect, to be no way, short of physical occupation, to attain a complete halt in the flow of men and supplies through Laos into South Vietnam.

To maintain the logistic support of the Communist forces in South Vietnam, the North Vietnamese also need an effective transport system within North Vietnam. Although the air offensive to date has disrupted and hindered the operation of the North Vietnamese transport system, it has not reduced it to a level below that needed to maintain essential traffic. During the last quarter of 1965 the volume of freight that was moved into the southern provinces of North Vietnam approached and may even have exceeded normal levels. The inventory of motor trucks, despite the losses from air attack, actually increased during 1965. It should be noted finally that the supply of the probably most essential factor -- petroleum -- was not reduced to critical levels during 1965. Moreover, even the intensified attack analyzed in this memorandum would not prevent the North Vietnamese from maintaining at least its essential imports of petroleum* -- and hence its ability to supply the forces in South Vietnam.

* See Appendix C.

6. Estimate of Civilian Casualties

The air attack analyzed in this memorandum extends into areas of North Vietnam that have been relatively untouched by previous US/GVN air strikes. The specific target locations are for the most part in sparsely populated areas. Only one of the four electric power targets is in a relatively heavily populated area. The petroleum storage targets are all in lightly populated areas or on the outskirts of larger cities. Several of the major transport targets are in close proximity to heavily populated areas. It is estimated, however, that previously executed evacuation programs, the extensive civil defense measures, and the present form of US/GVN air attacks all make it unlikely that civilian casualties will reach unacceptable levels. They would, however, be proportionately higher and would be inflicted within a much shorter time phase than the casualties experienced under the US/GVN air campaign during 1965.

This estimate of civilian casualties is based on factors derived from an analysis of the US/GVN attacks through October 1965. On this basis, it is estimated, that the civilian casualties resulting from the attack on preestablished and fixed targets will be at least 2,000 to 3,000. Additional civilian casualties resulting from armed reconnaissance missions may be computed at a minimum rate of 300 civilian casualties for each 1,200 armed reconnaissance sorties. In the past, no more than 1,200 armed reconnaissance sorties have been authorized for a two-week period.

Medical services in North Vietnam are inadequate to meet the nation's normal public health needs. These services, therefore, can provide only minimum emergency care and treatment of additional civilian casualties. The small numbers of civilian medical and paramedical personnel (estimated to include 1,400 physicians, 2,300 doctors' assistants, and 8,000 nurses in 1965), most of whom are poorly trained, are unable to cope with the high incidence of nutritional, infectious, and parasitic diseases. They presumably have been hard-pressed to service the relatively few war casualties sustained thus far. The civilian and military hospitals (only 25,000 beds), convalescent homes, and villages medical stations are, with few exceptions, poorly equipped and chronically overcrowded. Moreover, with the exception of several important combat-related items, medicines are in short supply. The exceptions are mainly penicillin, blood plasma, and sulfa drugs, large stocks of which have been accumulated as a result of greatly increased imports during the past year. The stockpile of penicillin is estimated to be sufficient, according to US experience, to meet the needs of more than 800,000 troops in active combat for one year.

APPENDIX A

EFFECT OF ATTACKS ON ELECTRIC POWER FACILITIES

The proposed escalation of air attacks against electric power facilities would put out of operation the important thermal power stations at Hanoi, Thai Nguyen, and Hon Gai as well as the vital Dong Anh substation, which feeds power from three sources to the city of Hanoi. Destruction of these facilities would raise the total loss of power-generating capacity to 118,000 kilowatts, or 67 percent of national capacity. These strikes would bring modern industry in the affected areas to a complete halt and would severely disrupt the highly electrified operations at the port of Cam Pha. Some of the major industrial installations that would be forced to shut down are the Hanoi machine building plant, the Nam Dinh textile plant, the Thai Nguyen iron and steel plant, the iron ore mines at Thai Nguyen, and the coal mines at Hon Gai. In each case the enterprise is the major if not exclusive producer of its kind in the country. Many of the enterprises are also highly regarded show projects. The attacks postulated in this memorandum leave some 33 percent of national electric power capacity intact. Some of this capacity is accounted for by small plants not connected with the main grid. However, three important plants not included among those targeted in the proposed escalation -- one at Viet Tri and two at Haiphong -- account for 19 percent of national generating capacity.* The industries they support could therefore continue to function. The most important of these are the cement plant at Haiphong and the paper mill, the chemical combine, and the sugar refinery at Viet Tri. It is unlikely that the powerplants situated at Haiphong would have excess capacity for transmission to Hanoi. In any case the distance and limited carrying capacity of the 35-kilowatt line between Haiphong and Hanoi will restrict the maximum load that could be transmitted to perhaps 3 to 5 megawatts, or only a small fraction of Hanoi's requirements. Although the powerplant at Viet Tri would have surplus capacity to supply power to the main grid, the loss of the Dong Anh substation would forestall effective use of this excess capacity at least temporarily. The substation probably

* The exclusion of these plants is arbitrary. The selection of targets in this sector included only those installations necessary to effectively cripple the operations of the main grid system and to cause the most important industrial activity to cease operations.

could be put back into partial operation in as little as two months, provided technical assistance is available, by transferring equipment from substations elsewhere in the country. Thus it would be necessary to maintain some surveillance on this target to determine the necessity of a restrike.

If the attacks on the electric power facilities are effectively executed, the North Vietnamese would be hard-pressed to restore power to the degree necessary to resume industrial production. Destruction of the targeted power facilities would also deny to agriculture an estimated 30 to 40 percent of the power supply presently used in agriculture. The country lacks both the capability to manufacture the required equipment and the technical skills necessary to reconstruct the powerplants. Even with outside assistance, their reconstruction would require from one to two years. For this reason the attacks against electric power facilities, once successful, would not require sustained strike operations by US/GVN forces.

It should be expected that power requirements for essential services such as command posts, communication centers, and hospitals can be maintained through the use of mobile diesel generators. Restricted power supply in Haiphong probably will result in drastic reduction, if not elimination, of street lighting and consumption of electricity by private households. It is also likely that industrial requirements for power in Haiphong will not be fully met without alteration of work schedules to reduce demands during peak load hours. With the exception of the 32-megawatt Hanoi thermal powerplant, which can supply an estimated 70 percent of Hanoi's power, all facilities proposed as targets for escalation of air attacks are located in relatively sparsely populated areas. The Hanoi plant, although situated in the northwestern outskirts of the city, is bordered on two sides by dense residential housing.

APPENDIX B

EFFECT OF ATTACKS ON PETROLEUM STORAGE FACILITIES

Previous air strikes against bulk petroleum facilities destroyed or rendered useless four storage facilities which represented about 37,000 tons of bulk storage capacity. The proposed expansion of air strikes against nine major storage terminals would deprive the regime of an additional 168,000 tons of capacity. There would remain only some 7,000 tons of storage dispersed in a variety of untargeted locations and some 2,200 tons in small buried tanks at seven newly identified dispersed storage facilities. Thus the planned attacks would eliminate the principal bulk petroleum terminals in North Vietnam and would preclude the delivery of petroleum supplies in bulk by tankers. About 90 percent of North Vietnam's imports of petroleum currently are delivered by tanker.

In 1965 the total supply of petroleum, all imported, was about 175,000 tons. Although coal is the principal source of primary energy, this amount of petroleum probably represents North Vietnam's minimum essential needs. The distinction between military and civil consumers is not always clear, but it is estimated that about 60 percent of the total supply is consumed by the military. The remainder is consumed chiefly by civilian motor and water transport.

The loss of petroleum storage facilities -- and their contents -- would have an immediate effect on the economy. The effect on normal industrial production activities would be slight because most of the industrial enterprises in North Vietnam rely on coal or electricity for energy. Consumption of petroleum by individual civil consumers is negligible. The major effect in the civilian economy would be in transportation. Civilian motorized transportation would come to a quick halt if imports of petroleum were interdicted continuously. The transport of food, raw materials, and finished goods would be curtailed drastically. Relief would be found only to the extent that priority transport and distribution problems could be handled by primitive means of transport or through use of existing stockpiles.

Data on stockpiles of petroleum in North Vietnam, including that in drums and small buried tanks, are not available. The inventory represented by these expedients and by untargeted facilities is small, totaling only about 10,000 tons -- less than a month's supply at current supply rates.

A sustained loss of petroleum storage facilities coupled with an inability to import even minimum operating requirements would have its greatest effect on military operations. North Vietnamese military forces account for about 60 percent of total petroleum consumption, or a monthly average of about 8,500 tons. North Vietnam with Chinese cooperation would probably be able to maintain petroleum imports at almost normal levels even after the intensified attacks discussed in this memorandum. Therefore, the supply of essential imports of petroleum for military requirements would appear to be almost certain. The methods by which this could be done are discussed in Appendix C.*

* For a discussion of the effect on transportation of a denial of petroleum and the ability of transport to handle minimum essential imports of petroleum, see Appendix C.

APPENDIX C

EFFECTS OF INTERDICTION OF RAIL AND SEA TRANSPORT

For the purposes of this memorandum, it was assumed that an escalated air attack on the Hanoi-Haiphong area would continue the interdiction of 22 major rail, highway, or combination rail/highway bridges on [REDACTED]. These targets are on transport routes that connect the major industrial centers with each other and with P'ing-hsiang, China, and the port of Haiphong. [REDACTED] also includes seven other transport targets on the same routes, three port facilities, the minable area at Haiphong, and the major railroad repair shop near Hanoi. If all of these targets were effectively and repeatedly attacked in an escalated bombing schedule, it could be assumed that rail transport would almost cease.** Truck transport, on the other hand, probably would be disrupted but would continue to meet essential requirements by the use of alternate routes, fords, ferries, and pontoon bridges, where necessary. Seaborne foreign trade would also be greatly restricted, and domestic water transport would be handicapped. Water and motor transport and port operations would be further restricted if the major petroleum storage and electric power facilities were destroyed.

The elimination of rail transport and the reduction of motor and water transport would seriously affect the overall availability of transport capacity. Of the 1.8 billion ton-kilometers performed by modern transport in 1964, railroads accounted for a little more than 50 percent, highways 10 percent, inland waterways nearly 30 percent, and coastal waterways nearly 10 percent. In terms of tons carried, railroads

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** The experience during World War II and the Korean War suggests that this assumption is unrealistic. The objective of keeping these bridges and lines of communication constantly interdicted to the degree necessary to halt all rail traffic is probably impossible to attain. Bombing and strafing missions would have to exceed considerably the maximum of 1,200 armed reconnaissance sorties allowed under any previous two-week Rolling Thunder authorization. Therefore, some rail traffic would always be able to move between the interdicted sections of a given route, and some through movements would be accomplished by improvisation. Although the amount of through movement cannot be quantified, it will not be large enough to invalidate the general conclusions and analysis of this estimate.

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accounted for 22 percent, highways 38 percent, inland water 38 percent, and coastal water 2 percent. The railroads serve mainly the industrial and extractive sections of the economy and the military establishment, whereas highway transport and water transport are used for both these sectors and for a portion of the agricultural sector.

In 1965, Haiphong handled at least 1.2 million tons of seaborne cargo. Import cargo amounted to at least 680,000 tons, of which nearly 170,000 tons consisted of bulk petroleum products, and export cargoes amounted to 550,000 tons, of which 320,000 tons were shipments of apatite ore. Coal exports from the ports of Hon Gai and Cam Pha amounted to 1.1 million tons. Additional foreign trade in 1965 via the rail line to China amounted to about 300,000 tons of imports and 150,000 tons of exports. About one-half of these imports are believed to have been coal for the blast furnaces at Thai Nguyen and about 30 percent were probably military supplies.

Thus, with rail transport and the flow of imports through the ports interrupted, modern industry would soon be at a standstill unless there were substantial stockpiles of raw materials at the plants. Even if the plants continued to operate, internal distribution or export of their products would be handicapped by insufficient transport.

1. The Transport of Petroleum

If North Vietnam is forced to forego most of its industry and foreign trade as the result of the escalated attacks, the most crucial item needed to support the agricultural economy and the military operation would be petroleum. Nearly all of the petroleum is used for transportation, with about 60 percent allocated to the military and 40 percent to civilian use. It is estimated that 70 percent of the total is used for truck transport, 15 percent for water transport, and the remainder is used for agriculture, air transport, and home use. With the destruction of the major petroleum storage facilities, less than a month's supply of petroleum would be available in the short run. If this could be all allocated to military truck transport, it would possibly keep the trucks running for several weeks. It is unlikely that such an allocation could be made, however, as the fuel would not all be in the proper locations for military use, and some would be used for essential civilian traffic.

In a reasonable period of time, the North Vietnamese with the help of China could organize some emergency supply of petroleum. Tank trucks or trucks with petroleum in drums could be used between

the Chinese rail system at P'ing-hsiang and Hanoi, a distance of about 120 miles. Given sufficient time and additional expense and effort the total amount of petroleum normally consumed by North Vietnam -- some 15,000 tons a month -- could be delivered at Fort Bayard in China and moved by rail to P'ing-hsiang. Assuming that trucks could make the round trip from P'ing-hsiang to Hanoi in four days in spite of interdiction, about 800 trucks could probably handle this volume and almost certainly could handle the reduced requirements that would result from attacks on other targets. It is more likely, however, that this method would be used only to supply the Hanoi area and the upper Red River delta. The area along the North Vietnamese coast would most likely be supplied from China by small oceangoing tankers or by barge, junk, or other small craft. The tankers would have to offload into oil barges or lighters, as it is assumed that they could not enter the ports, because of mining and damage to port facilities and craft. Trucks and inland water craft could be used to distribute the petroleum inland from the coast. The capability to maintain almost the normal level of petroleum imports through various emergency procedures makes it rather certain that all military requirements could be satisfied. Even on a worst-case basis the regime could meet its most essential requirement for petroleum -- that needed to maintain the logistic pipeline to South Vietnam. At the end of 1965 the North Vietnam forces in Military Region IV (MR IV) (including the four southern provinces of North Vietnam) were estimated to have been consuming petroleum at a rate of roughly 1,500 short tons a month. This petroleum supports three major activities: (a) the maintenance of lines of communication and transport facilities within MR IV and leading from North Vietnam to Laos, (b) the operations associated with the use of MR IV as a military staging area, and (c) the actual movement of men and supplies into Laos and South Vietnam.

Maintaining a monthly import requirement of 1,500 short tons a month would not be a severe problem. This amount could, for example, be moved by coastal transport to points in MR IV, thus reducing to a minimum distance the overland haul by motor truck.

The share of the 1,500 short tons of petroleum consumed monthly by MR IV for the actual movement of supplies to South Vietnam is small. At the 1965 scale of combat it would take on the order of 60 short tons of petroleum a month to move the daily external logistic requirement of 12 short tons a day. With the escalation of combat and increase of forces represented by a daily external logistic requirement of 165 short tons a day,

the petroleum requirement for the actual movement of supplies would be in the order of 800 short tons a month. This would increase the monthly requirement of MR IV to less than 2,500 short tons of petroleum. This amount is well within the estimated postattack capabilities of North Vietnam.

2. Effect of Escalation on Internal Distribution

If modern industry were forced to a standstill by escalated attacks on transportation, petroleum facilities, and electric powerplants, demands for internal distribution for the industrial sector would be almost eliminated. The reduced demand for petroleum for the industrial sector would permit the allocation of most of the available petroleum to the movement of military supplies, agricultural products, and other civilian necessities such as civil defense items and medicines. This transport capacity, in addition to the use of nonmotorized water craft, carts, bicycles, and other forms of native transport, would probably take care of all essential civilian and military distribution.

The immediate and direct effect of the interdiction of the transportation system on the availability of food would be minimal. The major harvest of the year has been completed within the past two months, and the marketed crop probably has already been moved into the cities. Existing food storage facilities in the countryside are so decentralized that they require very little transportation.

The food situation in the cities, mainly Hanoi, Haiphong, and Nam Dinh, apparently has not been good in recent years. In 1964 and 1965, North Vietnam's imports of food are estimated to have been between 100,000 and 200,000 tons, or an amount equal to about 2 to 4 percent of the annual rice crop. The interdiction of these imports would cause some further tightening of belts but would not be calamitous.

The long-range effect on the production and distribution of food could be more serious. Further bombing could aggravate manpower shortages and further disrupt that part of the irrigation system that depends on petroleum and electric power. These cumulative factors could cause a shortfall in the spring rice crop of 1966. This shortfall plus the need for transport to move sufficient supplies into the cities could aggravate distribution problems. The transport problem would not be serious, however, because only 4 percent of the population lives in the three largest cities and only 7 percent lives in all the cities

of more than 10,000 persons. If industry were to cease operating, more people could be moved out of the cities and onto the farms to produce more food and to ease the distribution problem.

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APPENDIX D

ALTERNATIVE TARGET SYSTEMS

The attack analyzed in this memorandum is only one of several possible variants in target systems which could be devised to inflict significant economic losses on North Vietnam while attempting to attain the two basic objectives of the Rolling Thunder program: (1) to reduce the ability of North Vietnam to support the operations of Communist insurgent forces in Laos and South Vietnam, and (2) to increase progressively the level of damage in North Vietnam to the point where the will of the Hanoi regime to continue Pathet Lao and Viet Cong activities will be critically weakened and will ultimately cease.

The attack analyzed in this memorandum is designed essentially to yield maximum economic impact with a low order of physical damage and civilian casualties. Further escalation against economic targets conducted within these restraints would generally limit an expansion of the air offensive to attacks on untargeted electric power facilities.

Successful attack on the three remaining thermal powerplants would eliminate the 33 percent of total generating capacity left after the attack analyzed in this memorandum. Loss of the 16,000-kilowatt thermal plant at Viet Tri would stop production at North Vietnam's new paper mill at Viet Tri and the chemical combine and sugar refinery in that city. A successful attack on the 12,000-kilowatt thermal powerplant at the Haiphong cement plant would deprive the city of Haiphong of two-thirds of its remaining source of electric power. It would, moreover, deprive North Vietnam of its major domestic source of cement. This loss, if not replaced by imports of cement, would have a significant impact on military construction programs, on major reconstruction of bomb damage, and on repair projects. An attack on the third remaining powerplant, the 6,000-kilowatt Haiphong thermal powerplant, would deprive Haiphong of its last remaining source of power. This plant has been essential for local industrial use and as a source of standby power.

A second type of escalation against economic targets in addition to those already discussed could include direct attacks on industrial facilities. These attacks would, of course, yield a higher order of

physical damage and inflict greater casualties. The most important of these targets would be six major heavy manufacturing plants:

1. Hanoi Engineering Plant. This modern plant, which was a key Soviet aid project, is highly prized by the North Vietnamese as a symbol of advanced technology.
2. Thai Nguyen Iron and Steel Plant. This 100,000-ton steel mill, which is being built with Chinese aid, is the most expensive foreign aid project to be built in North Vietnam. The plant is already producing pig iron and was expected to be producing crude steel and some rolled products by the end of 1965.
3. Haiphong Cement Plant. This plant is the only significant cement producer in North Vietnam. It supplies nearly all the cement for construction and bomb-damage reconstruction activity in the country and has had an important export capability.
4. Viet Tri Chemical Combine. This new plant, built by the Chinese and East Germans, is the center of the industrial chemicals industry in North Vietnam.
5. Lam Thao Superphosphate Fertilizer Plant. This new installation, with a present capacity of 100,000 tons annually, is the largest operating chemical fertilizer plant in North Vietnam. The plant is a major Soviet aid project, and its capacity is being expanded to 150,000 tons annually.
6. Ha Bac Nitrogenous Fertilizer Plant. This major new chemical fertilizer plant is a technically advanced Chinese aid project. The plant, scheduled to go into operation in 1966, will have an initial capacity of 100,000 tons of ammonium nitrate. It is of major importance to agriculture but may also be the means of establishing an explosives industry in North Vietnam.

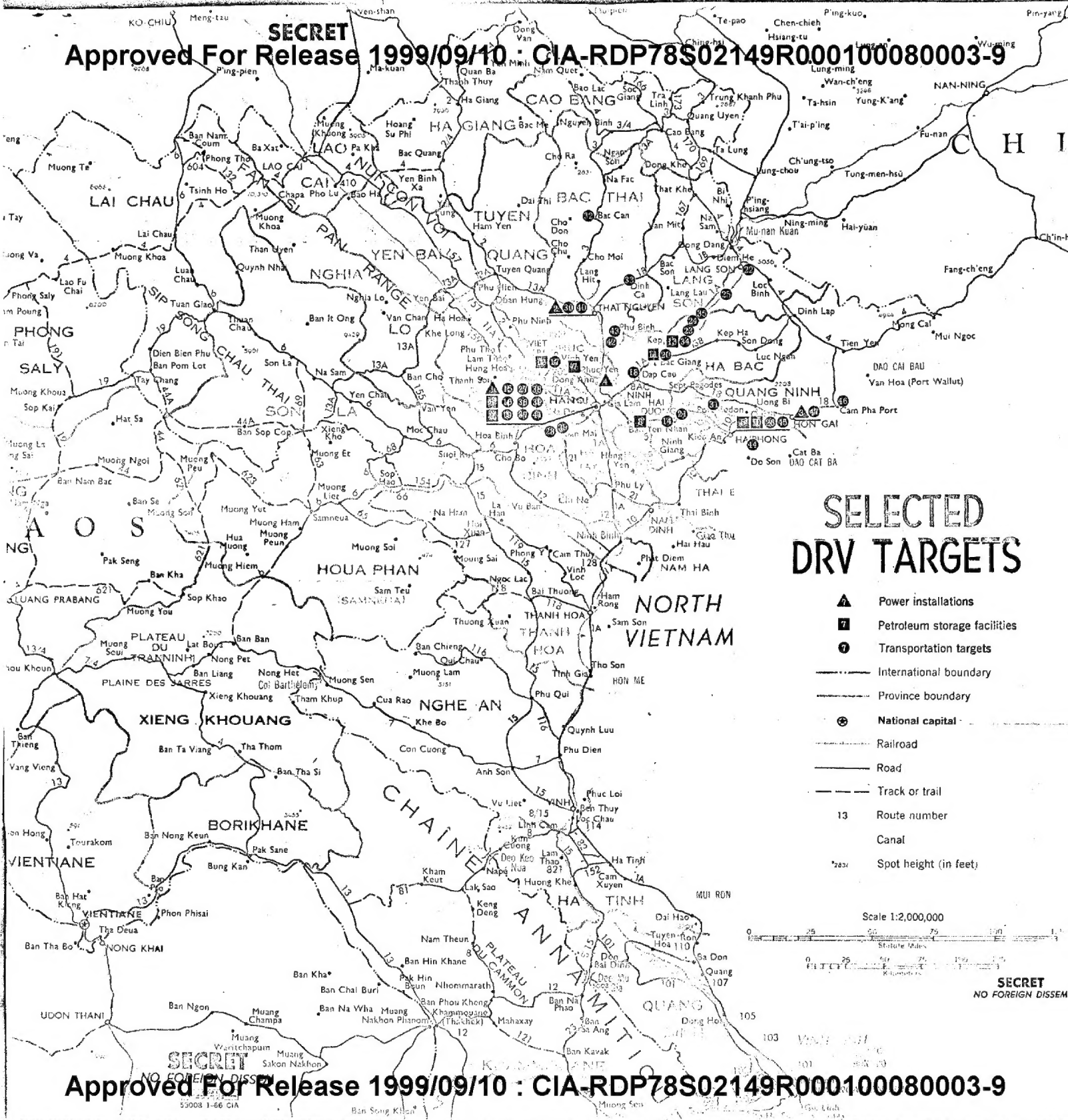
Successful attacks on these facilities would physically eliminate the industrial base of North Vietnam and cause it to revert to an almost totally agrarian society. There would be a considerable psychological loss associated with the loss of these major examples of North Vietnam's economic progress. The physical loss of the industrial base in and of itself would have very little bearing on North Vietnam's ability to support the operations of Communist forces in Laos and South Vietnam.

Furthermore, this physical loss alone, even with the attendant psychological impact and greatly increased civilian casualties, would not compel the regime to enter into negotiations until it either experienced or anticipated with certainty an unacceptable scale of losses and military defeat in the South.

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